

Natural history clues to the evolution of bivalved gastropods (Mollusca: Gastropoda: Sacoglossa: Juliidae)

ABSTRACT

Bivalved gastropods (family Juliidae) are a pan-tropical group of small, green, extraordinary gastropods with a symmetrical clam-like shell. Only a single species of Juliidae has been reported in Malaysia, *Berthelina singaporensis* Jensen, 2015, feeding on multiple species of siphonous green algae in the genus *Caulerpa*. In spite of a baseline expectation for megadiversity in this region, including 13 recorded species in the genus *Caulerpa* from two small field sites studied here, *B. singaporensis* appears to be a relative generalist without preferences among available *Caulerpa* spp. that occur in suitable (micro)habitats. The life cycle of Juliidae includes univalve, coiled larvae that transform to bivalved adults. In the presence of *Caulerpa*, swimming veligers rapidly settle and begin feeding; in a later, terminal metamorphosis, the larval operculum is shed, and the teleoconch shell field splits to form a second, right valve of the adult bivalved form. By three days after hatching, settled larvae achieve a fully functional bivalved shell with a working hinge. Both veligers and adults produce an unusual elastic mucous tether to maintain attachment to the substratum or food plant. These animals are dependent on *Caulerpa* for their entire life cycle; so, adults occupy environments where dislodgement may be a substantial risk. In the adult, bivalved, form, the gastropod can withdraw completely into its shell and close the valves while maintaining the byssus-like tether. This arrangement, enabling the gastropod to be simultaneously anchored to the food plant and protected within the shell, suggests that being able to use a byssus is the most plausible adaptive explanation for the evolution of the bivalved form within gastropods.

Keyword: Tropical biodiversity; Molluscan evolution; Adaptation